Application No.: 10/686,752
Office Action Dated: August 23, 2005
Response to Office Action Dated: October 12, 2005

In the Claims:

1. (Currently Amended) A method for determining optimum bond parameters including a bond force F_B and an ultrasonic variable P_B of a ~~Wire Bonder~~ wire bonder for a bond process, whereby for this determination a number of bond cycles are carried out, whereby for each bond cycle a wire connection is made between a connection point of a semiconductor chip and a connection point of a substrate in that a wire end protruding out of a capillary is melted into a ball and then, in a bond position, the wire ball is attached to the connection point of the semiconductor chip, then the wire is pulled through to the required length, formed into a wire loop and attached to the connection point of the substrate, and whereby the bond parameters to be optimized are each varied in discrete steps within a predefined range, wherein with each bond cycle n, after attaching the wire ball to the connection point of the semiconductor chip, the following steps are carried out:

a) ~~Applying~~ applying a predetermined bond force F_{Bl},

b) ~~Moving~~ moving the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored in the course of time t,

c) ~~Stopping~~ stopping the capillary as soon as the current $I_n(t)$ decreases,

d) ~~Determining~~ determining a maximum of the current $I_{n,max}$ from the progression of the current $I_n(t)$ established during steps b) and c),

and wherein from the values $I_{n,max}$ established with the n bonding processes those values for the bond parameters are determined as optimum bond parameters for which $I_{n,max}$ reaches a maximum.

2. (Currently Amended) A method for determining optimum bond parameters including a bond force F_W and an ultrasonic variable P_W of a ~~Wire Bonder~~ wire bonder for a bonding process, whereby for this determination a number of bond

cycles are carried out, whereby for each bond cycle a wire connection is made between a connection point of a semiconductor chip and a connection point of a substrate, in that a wire end protruding out of a capillary is melted into a ball and then, in a bond position, the wire ball is attached to the connection point of the semiconductor chip, then the wire is pulled through to the required length, formed into a wire loop and attached to the connection point of the substrate, and whereby the bond parameters to be optimized are each varied in discrete steps within a predefined range, wherein with each bond cycle n after attaching the wire to the connection point of the substrate the following steps are carried out:

a) ~~Applying~~ applying a predetermined bond force F_{W1},

b) ~~Moving~~ moving the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored in the course of time t,

c) ~~Stopping~~ stopping the capillary as soon as the current $I_n(t)$ decreases,

d) ~~Determining~~ determining a maximum of the current $I_{n,max}$ from the progression of the current $I_n(t)$ established during steps b) and c),

and wherein from the values $I_{n,max}$ established with the n bonding processes those values for the bond parameters are determined as optimum bond parameters for which $I_{n,max}$ reaches a maximum.

3. (Currently Amended) A method for in situ monitoring of the quality of bond connections which are produced by means of a wire-feeding capillary of a ~~Wire Bonder~~ wire bonder with predetermined values F_1, P_1, G_1 of a bond force F, an ultrasonic variable P and at least one further bond parameter G, wherein a to be tested, selected bond connection is made as follows:

~~Making~~ making a bond connection with predefined values F_2, P_2, G_2 for the bond force F, the ultrasonic variable P and the at least one further bond parameter

G, whereby at least one of the values F_2, P_2, G_2 is less than the corresponding value F_1, P_1, ~~G_1~~ G_1,

~~Carrying~~ carrying out a test according to the following steps:

a) ~~Applying~~ applying a predetermined bond force F_s,

b) ~~Moving~~ moving the capillary out of the bond position in a predetermined direction whereby a current I(t) flowing through the drive which moves the capillary is monitored over the course of time t,

c) ~~Stopping~~ stopping the capillary as soon as the current I(t) decreases,

d) ~~Determining~~ determining a maximum current I_{max} from the progression of the current I(t) established during steps b) and c);

and

~~Making~~ making the bond connection with the values F_1, P_1, G_1.

4. (Original) The method of claim 3, wherein the value P_2 is less than the value P_1.